

# EXHIBIT C 334.10 and 334.12

## From John Plourde

In Portsmouth NH in 2017 we adopted an amendment for NM cable (Romex) for one and two family only. Ten other cities have adopted more stringent codes than the NEC along with Portsmouth. Exhibit 1 is a list of a few places I found online in just a few minutes. The cost of NM cable seems to be the driving factor, but now MC Cable is cheaper. See Exhibit #2 from supply house printed 7-20-21 last week.

Fires caused by rodents is also a big concern. Rats, mice, and other rodents chew on the cables in attics, walls, floors, and any place they can get into. The reason is that their teeth need to be worn down just like a beaver and the soft outside coating of the NM is perfect to do that. (Exhibit 3)

Another factor with NM cable is the fumes given off by burning NM cable during a fire. Exhibit 4 has 5 pages of information about the coating of the insulation on NM cable.

These are the main reasons we did the amendment on NM cable and SER cable in the Portsmouth amendments.

If this amendment passes, NM cable which produces toxic fumes will be allowed in type 1 and 2 construction. This means during a fire, toxic fumes will spread throughout the building during evacuation. Supermarkets, large office buildings, large apartment houses over 4 floors per the IRC code would be type 1 or 2 construction.

For the cost difference, it does not make any sense to allow NM cable to be installed above drop ceilings and in type 1 and 2 construction.

Now NM cable costs **more**! Let's drop this out of the amendments.

This is a life safety issue and should not be an amendment to the NEC.

NEW HAMPSHIRE STATE BUILDING CODE  
PROPOSED AMENDMENT FORM

XB

Proposed amendment submitted by:

Name: William D. Fraser

Date: 17 May 2021

Company /Organization: Building Code Review Board, NEC Subcommittee

Address: \_\_\_\_\_

Telephone: (603) 524-2769 E-mail: bfraser@geicorp.net

Applicable code:

Applicable code section:

Select only one code: IEBC-15 IBC-15 IRC-15 IPC-15 IMC-15 IECC-15 IEBC-15 **NEC-20 (NFPA 70)**

Current language (including section numbers and include prior adopted amendments):

**NEC-20 Language**

**334.10 Uses Permitted.** Type NM and Type NMC cables shall be permitted to be used in the following, except as prohibited in 334.12:

(2) Multi-family dwellings permitted to be of Types III, IV, and V construction.

(3) Other structures permitted to be of Types III, IV, and V construction. Cables shall be concealed-installed within walls, floors, or ceilings that provide a thermal barrier of material that has at least a 15-minute finish rating as identified in listings of fire-rated assemblies.

**334.12 Uses Not Permitted**

**(A) Types NM and NMC.** Types NM and NMC cables shall not be permitted as follows:

- (1) In any dwelling or structure not specifically permitted in 334.10(1), (2), (3), and (5)
- (2) Exposed within a dropped or suspended ceiling cavity in other than one- and two-family and multifamily dwellings
- (3) As service-entrance cable
- (4) In commercial garages having hazardous (classified) locations as defined in 511.3
- (5) In theaters and similar locations, except where permitted in 518.4(B)
- (6) In motion picture studios
- (7) In storage battery rooms
- (8) In hoistways or on elevators or escalators
- (9) Embedded in poured cement, concrete, or aggregate
- (10) In hazardous (classified) locations, except where specifically permitted by other articles in this Code

**334.30 Securing and Supporting**

**(B) Unsupported Cables**

(2) Is not more than 1.4 m (4 1/2 ft.) from the last point of cable support to the point of connection to a luminaire or other piece of electrical equipment and the cable and point of connection are within an accessible ceiling in one-, two-, or multifamily dwellings.

XC

**Currently Adopted Amendment EL-17-01-17**

**334.10 Uses Permitted.** Type NM, Type NMC, and Type NMS cables shall be permitted to be used in the following, except as prohibited in 334.12:

(2) Multi-family dwellings permitted to be of Types III, IV, and V construction.

(3) Other structures permitted to be of Types III, IV, and V construction. Except as permitted by 334.10 (6), Cables shall be concealed within walls, floors, or ceilings that provide a thermal barrier of material that has at least a 15-minute finish rating as identified in listings of fire-rated assemblies.

Exception to (2) and (3): For buildings or structures required to be of Type I or Type II construction, Type NM, Type NMC, and Type NMS cables shall be permitted to be used, provided that where so applied in buildings or structures exceeding three stories above grade, circuits run in Type NM, NMC, or NMS cable shall not leave the floor or dwelling unit from which the circuits originate

(6) Exposed within

- a. dropped and suspended ceiling cavities
- b. accessible attics and roof spaces
- c. unfinished basements and crawl spaces

Except as permitted by 334.30 (B) (2) for connections to luminaires and equipment, cables shall be installed to closely follow the surface of framing members, running boards, or the equivalent

**334.12 Uses Not Permitted.**

**(A) Types NM, NMC, and NMS.** Types NM, NMC, and NMS cables shall not be permitted as follows:

(1) In any dwelling or structure not specifically permitted in 334.10(1), (2), (3), and (5)

~~(2) Exposed within a dropped or suspended ceiling cavity in other than one- and two-family and multifamily dwellings~~

~~(3) As service-entrance cable~~

~~(4) In commercial garages having hazardous (classified) locations as defined in 511.3~~

~~(5) In theaters and similar locations, except where permitted in 518.4(B)~~

~~(6) In motion picture studios~~

~~(7) In storage battery rooms~~

~~(8) In hoistways or on elevators or escalators~~

~~(9) Embedded in poured cement, concrete, or aggregate~~

~~(10) In hazardous (classified) locations, except where specifically permitted by other articles in this Code~~

**334.30(B)(2)** Is not more than 1.4 m (4 1/2 ft.) from the last point of cable support to the point of connection to a luminaire or other piece of electrical equipment and the cable and point of connection are within an accessible ceiling. ~~in one-, two-, or multifamily dwellings.~~



Check one:     ☐ Delete without substitution:                     ☐ Add new section to read as follows:  
                 ☐ Delete section and substitute the following:     ☒ Revise section to read as follows:  
                 ~~Show Line through material to be deleted.~~                     Underline material to be added.

Proposed code language:

**334.10 Uses Permitted.** Type NM and Type NMC cables shall be permitted to be used in the following, except as prohibited in 334.12:

(2) Multi-family dwellings permitted to be of Types III, IV, and V construction.

(3) Other structures permitted to be of Types III, IV, and V construction. Except as permitted by 334.10 (6), cables shall be concealed within walls, floors, or ceilings that provide a thermal barrier of material that has at least a 15-minute finish rating as identified in listings of fire-rated assemblies.

Exception to (2) and (3): For buildings or structures required to be of Type I or Type II construction, Type NM, Type NMC, and Type NMS cables shall be permitted to be used, provided that where so applied in buildings or structures exceeding three stories above grade, circuits run in Type NM, NMC, or NMS cable shall not leave the floor or dwelling unit from which the circuits originate

(6) Exposed within

- a. dropped and suspended ceiling cavities
- b. accessible attics and roof spaces
- c. unfinished basements and crawl spaces

Except as permitted by 334.30 (B) (2) for connections to luminaires and equipment, cables shall be installed to closely follow the surface of framing members, running boards, or the equivalent

**334.12 Uses Not Permitted.**

**(A) Types NM, NMC, and NMS.** Types NM, NMC, and NMS cables shall not be permitted as follows:

- (1) In any dwelling or structure not specifically permitted in 334.10(1), (2), (3), and (5)
- ~~(2) Exposed within a dropped or suspended ceiling cavity in other than one- and two-family and multifamily dwellings~~
- ~~(3)~~ (2) As service-entrance cable
- ~~(4)~~ (3) In commercial garages having hazardous (classified) locations as defined in 511.3
- ~~(5)~~ (4) In theaters and similar locations, except where permitted in 518.4(B)
- ~~(6)~~ (5) In motion picture studios
- ~~(7)~~ (6) In storage battery rooms
- ~~(8)~~ (7) In hoistways or on elevators or escalators
- ~~(9)~~ (8) Embedded in poured cement, concrete, or aggregate
- ~~(10)~~ (9) In hazardous (classified) locations, except where specifically permitted by other articles in this Code



# Exhibit I

## NM CABLE 334.10 and 334.12 OTHER AMENDMENT

NEWINGTON NH  
ROMEX IS NOT ALLOWED IN COMERCIAL  
INSTALLATION

=====

BUREAU OF CONSTRUCTION CODES  
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### ARTICLE 334 USES PERMITTED

**334.10. Uses Permitted.** Type NM, type NMC, and type NMS cables may be used in the following:

- (1) **One- and 2-family dwellings.**
- (2) Multifamily dwellings except as prohibited in section 334.12 of the code.
- (3) Other structures except as prohibited in section 334.12 of the code. In structures exceeding 1 floor above grade, cables shall be concealed within walls, floors, or ceilings that provide a thermal barrier of material that has at least a 15-minute finish rating as identified in listings of fire rated assemblies in accordance with the Michigan building code.
- (4) Cable trays in structures permitted to be types III, IV, or V where the cables are identified for the use.

=====

**CITY OF ARRENVILLE ILLINOIS  
DELETED NM CABLE TOTALLY FROM USE IN ANY BUILDING**

=====

TITLE 14 HOUSING AND CONSTRUCTION  
CHAPTER 10 ELECTRICAL CODES  
PART 4 2014 NEW MEXICO ELECTRICAL CODE



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|--|--------------|
| 07/20/21   | S2321690     |
| ORDER TO:  | PAGE NO.     |
| INDEPENDENT ELECTRIC SUPPLY<br>177 GAY ST.<br>MANCHESTER NH 03103<br>603-627-2220 Fax 603-626-8283 | 1            |

QUOTE TO:  
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MANCHESTER, NH 03103

SHIP TO:  
COD - MANCHESTER  
CITY OF PORTSMOUTH  
JOHN PLOURDE  
MANCHESTER, NH 03103

| CUSTOMER NUMBER  | CUSTOMER ORDER NUMBER | RELEASE NUMBER  | SALESPERSON         |         |
|--|-----------------------|---|---------------------|---------|
| 6509   | QUOTE                 |   | HOUSE SALES ACCOUNT |         |
| WRITER   | SHIP YEA              | SHIP DATE   | FREIGHT ALLOWED     |         |
| RON CHEVRETTE  | PICK UP NOW           | 07/21/21  | No                  |         |
| ORDER QTY  | PART NO               | DESCRIPTION   | UNIT PRICE          | NET     |
| 1000e  | 7917                  | COPPER ROMEX 12/2-WG 250' COIL<br>98010026305                 | 692.424/m           | 692.42  |
| 1000ea   | 28276                 | COPPER MC 12/2 250FT COIL                                     | 688.235/m           | 688.24  |
| 1ea  | 215471                | ETN GFTCB250 2 POLE 50A GFST,<br>120/240V, 10 KAIC, #14-4 AWG | 145.946/ea          | 145.95  |
| 1ea  | 232800                | ETN GFTCB230 BR 2 Pole 30A Ground F                           | 78.541/ea           | 78.54   |
| 1ea  | 27906                 | ETN BR230 BR Circuit Breaker 10K                              | 14.583/ea           | 14.58   |
| 1ea  | 28000                 | ETN BR250 BR Circuit Breaker 10K                              | 14.847/ea           | 14.85   |
| 1ea  | 193709                | P&S 3232-W RECEP DUP 15A125V SCREW                            | 65.972/c            | 0.66    |
| 1ea  | 132881                | P&S 3232-TRW TR DUP REC 15A125V                               | 1.264/e             | 1.26    |
| 1ea  | 28994                 | CUTLER BR340 BR Circuit Breaker<br>78667636785                | 104.500/ea          | 104.50  |
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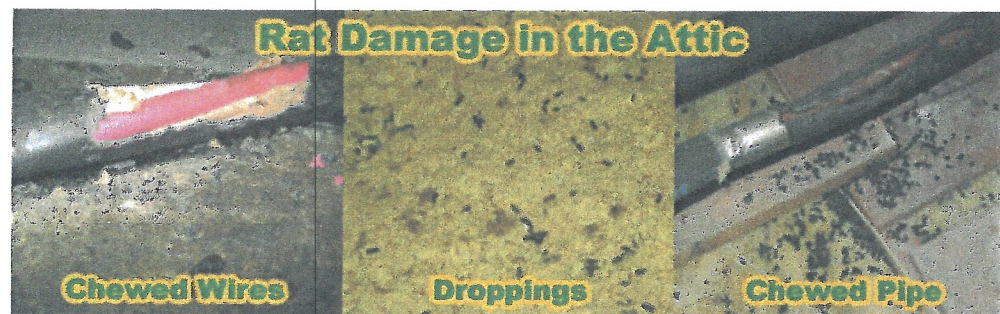
Others



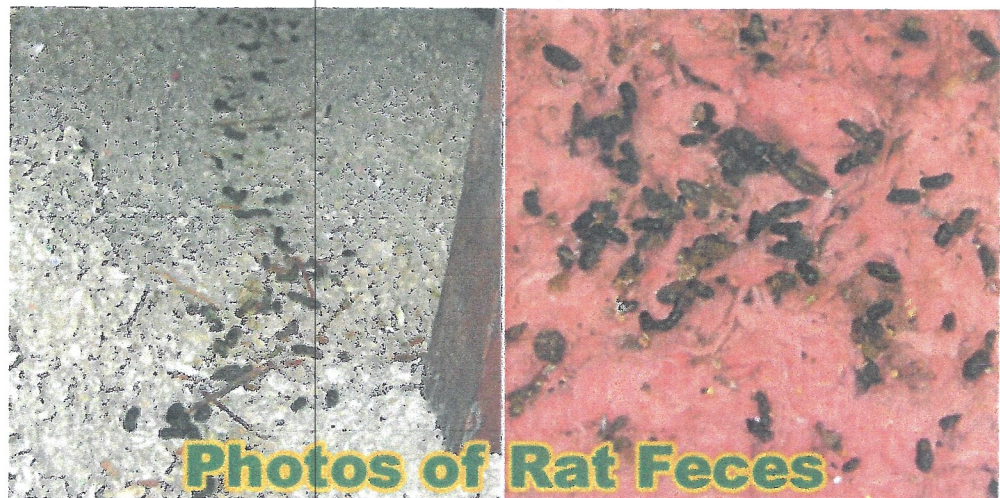
Dead

## Photos of Damage from Rats

Below are some photos of the types of damage rats can cause when they live in an attic of a house. If you need help with a rat infestation, click on this map of [Professional Rat Removal Companies](#) serving every town/city in the USA.



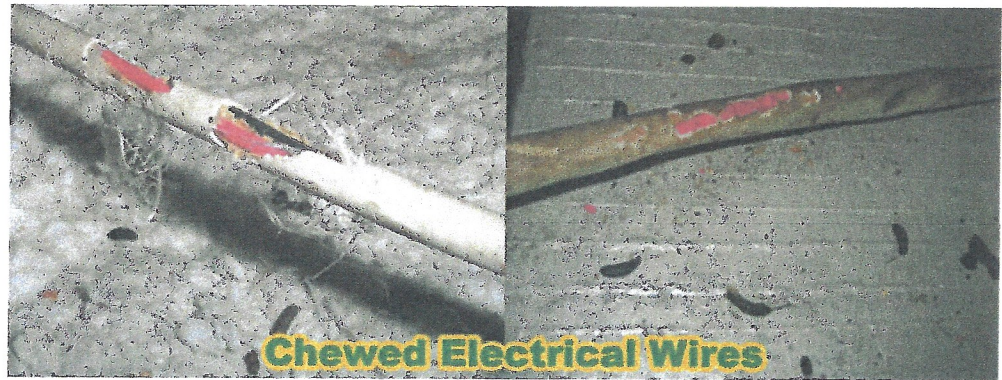
Here we've got a photo of a chewed electrical wire, then insulation that has been pooped all over and trampled down and peed all over (probably needs to be replaced) and then a picture of foam that's been chewed off from around a pipe. [Do Rats Destroy Insulation In An Attic?](#)



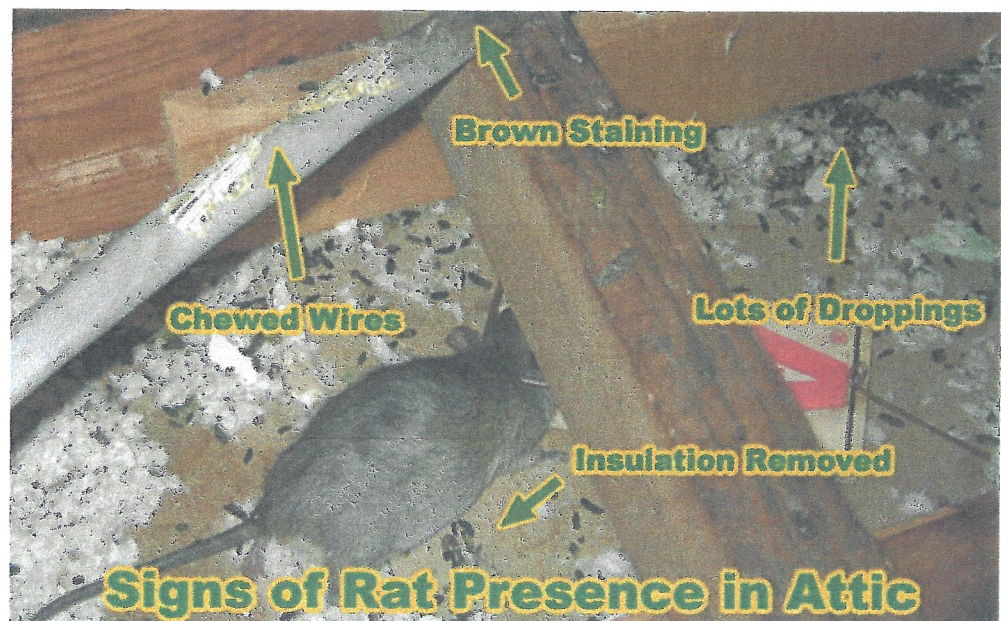
Some of the worst damage can be in the form of rat waste - lots of feces and urine, which stinks up the insulation, and actually lures in new rats, and even rat predators, by the scent.



# X3



Some more chewed electrical wires. If the wires are touching wood, which happens quite commonly in attics, yes, it can start a fire. The fire hazard from chewed electrical wires is one of the biggest risks of having rodents in your attic. They just have to chew, to wear down their teeth, and they'll chew on anything - they seem to like wires for some reason.



Here's a general photo that I took in an attic - all kinds of damage from rats, and a pretty typical scene - brown smudges from rat grease, chewed wires, lots of poop, etc. Now that you know about the different types of damage rats can cause, the below links should help you:

**Rat removal info** - main rat removal information page.

**How are rats getting in** - this is what you need to read if you want to solve the problem.

**How to trap a rat** - you're going to have to trap a few as well, so you need to read this too.

**How to get rid of rats** - just another general guide.

**Rat in building** - general information on different parts of buildings rats get into.

**Rat repellent** - do repellents and rodent deterrents work?

**Pest control for rats** - why to never hire a regular pest control company to do rat work.

**How to kill a rat** - another guide, helping to humanely solve the problem.

**Rat prevention** - some tips to keep rats away, and lessen the number in the area.

**Rats in the attic** - a good guide to one of the most common problem areas with rats.

**Photos of rat poop** - for identification purposes.

I will now address some of the more common questions that I receive about rats getting into a building:

Rat damage in the attic - most commonly to the insulation and wires, but if you've got PVC plumbing in the attic, they'll chew that as well, causing water leaks. They sometimes chew on the wood rafters too.

Rat damage in the basement - the usual, chewing on whatever you don't want them to chew on, from wires to plumbing to your personal goods. Plus all the rat feces they leave behind.



X3



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## How to Prevent House Fires Caused by Rodents: Use a Safe, Effective, Natural Rodent Repellent

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Posted by [Becky Smith](#) on December 16th, 2009 [Download Complimentary Guide\\*](#)

“Rats and mice cause 8% of all house and building fires in the U.S.,” says Kari Warberg Block. As the inventor of FRESH CAR® Mouse Pouch ([www.earthkind.com](http://www.earthkind.com)), Warberg Block is an expert on rodent behavior and specifically on ways to keep rats and mice out of buildings without using methods that endanger children or pets.

The U.S. averages 1.6 million home and building fires each year. In the last 10 years, more than 194,000 people have been injured in home and building fires, and almost 37,000 people have died. Rodents started 8% of all these fires by chewing through electrical wiring and causing a short—and most homeowner insurance policies don't cover fires caused by rodents.

If you think you're safe from the expense and heartbreak of rodent-caused fires, think again. “In the U.S., 30% of all homes contain unwanted rodents,” Warberg Block says. “In fact, these rats and mice are known as ‘commensal’ rodents. The term means eating at the same table with humans, and they're called that because they thrive in close proximity to people.”

Submit





X3

## To Prevent Electrical Fires Caused by Rodents, You Need a Rodent-Free House.

All rodents have prominent, continually growing incisor teeth. Because these teeth never stop growing, rats and mice find pleasure gnawing every day to wear down their teeth. If they don't, the incisors grow too big to gnaw food, and they cannot feed properly. That's why they like to make their home where there's plenty to chew on: between walls, in drop ceilings and subfloors, in attics and garages, behind appliances and in pantries.

One pair of mice can make 15,000 more mice in just one year. If your home is in the 30% that's already rodent-infested, call a rodent control expert for extermination methods that work and are safe. In addition to starting fires, rats and mice carry 35 known diseases, some of them fatal, so it's important to get them out of your home pronto. Do-it-yourself solutions such as poison and traps are dangerous to children and pets, leave a mess for you to clean up, and don't work all that well.

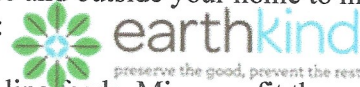
If you're lucky enough to not yet have rats and mice "eating at your table," doing some simple home maintenance and placing a rodent repellent in key locations will help prevent electrical fires caused by rodents. The best way to control rats and mice in your home is to make them feel unwelcome from the get-go so they never set up house in your house.

### FRESH CAB<sup>®</sup> Mouse Pouch is Safe, Effective, and EPA-Registered.

You can keep rats and mice out of your home, garage, storage unit, vehicles and any other enclosed places safely and effectively with rodent repellent: [FRESH CAB Mouse Pouch](#). FRESH CAB is the first botanical rodent repellent to earn federal Environmental Protection Agency (EPA) registration for safe, effective use indoors and in enclosed areas. FRESH CAB's main ingredient is balsam fir oil, which is safe and smells great to humans but which rodents hate.

Welcome to earthkind! Sign up now for news and offers & get a complimentary guide to prevent pests!

Here are some things you can do inside and outside your home to make mice and rats feel unwelcome and prevent house fires caused by rodents:



1. Caulk foundation cracks and utility line feeds. Mice can fit through a hole the size of a pencil eraser.
2. Cover ceiling vents, outside dryer vents, and soffits with wire mesh.
3. Trim trees and climbing vines so that rodents can't crawl up them to enter your home.
4. Make sure the bottom seals on all outside doors, including your garage door, are tight.
5. After you've done #1 through #4, place FRESH CAB Mouse Pouch inside your home at the site of foundation cracks, utility line feeds, ceiling vents, dryer vents and soffits and on either side of all outside doors.
6. Also place FRESH CAB in the pantry, under the kitchen and bathroom sinks, and in crawl spaces and drop ceilings—anywhere that mice and rats might feel inclined to settle in and breed.

For more information on how to keep your home rodent-free using a safe, natural rodent repellent, visit [www.earthkind.com](http://www.earthkind.com).

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mouse activity there can be a build up of fecal material, urine, and oily stains. A distinct odor and visual sightings during the daytime indicate a large population of mice is present. Even at low levels the damage and contamination caused by mice is a concern to all.



Mice and most rodents need to gnaw constantly to prevent their teeth from growing too large. As a result, mice will chew on anything they can find, including wires. Having evolved from ancestors in tropical environments, rodents are adept at grabbing and chewing small vines, twigs, and roots. This close resemblance to wiring in modern homes is of major consequence. Fire investigators assume that many fires of unknown origin were caused by rodents gnawing wires. As rodents chew through the outer vinyl and plastic coatings, the inner live copper wires become exposed allowing for direct arcing between positive and negative wires, causing a fire to start. Much can be done to control mice, starting with a **professional rodent inspection** for signs of rodent damage and activity.

**BACK TO BLOG**

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Insects/ Spiders

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Mice

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Mosquitoes

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Nuisance Wildlife

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Pests

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Rats

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# EXHIBIT 4 5 Pages

## A Fires originating in branch-circuit NM cables due to installation damage

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Source: In the Mouth of the Dragon by Deborah Wallace

### PVC FIRES: ELECTRICAL WIRING AND CABLE INSULATION

When PVC is exposed to even low levels of heat decomposition can occur, which releases the combustible gas, hydrogen chloride. If heat reaches high enough levels the concentrated gas ignites and spreads fire rapidly across wiring and cables, which are usually stored together, and which can be spread throughout a building uninterrupted.

### PVC FIRES: ELECTRICAL WIRING AND CABLE INSULATION (Examples)

#### SUFFOLK, NY, USA

December 28, 1991

A fatal subway fire trapped 900 straphangers in a smokey tunnel where two people sustained fatal injuries and 148 more suffered smoke inhalation. Two died, one of a heart attack, and the other, who had a history of asthma, of smoke inhalation. In addition, 188 riders suffered injuries, mostly from smoke inhalation. Passengers were trapped in the train for 36 minutes. Four people who had been trapped on the train described the incident as a nightmare that seemed to have no end, telling of passengers vomiting, having heart attacks, gasping for air and trying to break windows to escape the reddish-brown smoke created by burning PVC.

There was a five-minute gap between the time train operators tried to contact the TA command center and when the command center received word of the blaze. Although no samples were taken at the time of the fire, the city ordered McDogell Owens, specialists in researching fires and explosions, to analyze materials from the fire.

Attorneys for 40 people sued the TA for trapping them in the Clark Street tunnel, seeking a total of \$15 million in damages on the basis of their fear of exposure to toxic, cancer-causing polyvinyl chloride burned in the exposed piece of cable. One claimed that TA was negligent "in failing to have a proper evacuation plan and a delay in the rescue attempt."

The cable that is believed to have caused a short circuit and started the fire was encased in PVC. The smoke that poured through the IRT tunnel after the short circuit explosion came

**A** Fires originating in branch-circuit NM cables due to installation damage

↓ DOWNLOAD

problems at the switching exchanges. His predictions were based on the building design and the enormous concentrated amount of plasticized PVC cable sheathing and wire insulation.

The official Fire Department report lists 239 FDNY employees injured during the fire. One man died of a heart attack two weeks later. His autopsy revealed older, heavy deposits of greasy soot that had eaten its way completely through the lung on the pleural side. At the time of the death he still had lung edema, and he had dead patches on the lung.

Others became sick later. Delayed symptoms from inhalation of smoke from PVC or Teflon sometimes resemble flu, and firefighters may not have connected their "flu" with this fire.

A later survey of the injured firefighters showed other symptoms including acid-burned respiratory tracts, eyes and skin; inability to get enough oxygen because of lung damage; loss of control over limbs; impairment of the whole perception process; nausea and feelings of weakness and exhaustion; and confusion and disorientation.

Two of the men surveyed later died of rare cancers - one from a brain tumor and one from liver cancer. A third was the only firefighter who sued, because his lungs were so damaged that at the time of his court date, they were functioning at only 50 percent of what was normal for his size and age.

Sixty four percent of the firefighters reported permanent effects. The most common complaints included impaired disease resistance, coughing, hoarseness, sensitivity to smoke, asthma and repetitive bronchitis.

PVC in the stage of decomposition and combustion can deliver an acute dose of toxicants which result in permanent serious injury and even delayed fatalities.

If a local building code allows large quantities of PVC in a building, the fire department and other city agencies must budget and plan for major disaster, including the hospitalization of hundreds of people at a time.

Source: In the Mouth of the Dragon by Deborah Wallace

SOUTHGATE, KENTUCKY

May 18, 1977

The Beverley Hills Supper Club was a large multi-function entertainment center in the northern Kentucky near Cincinnati. The night of the fire over 2000 patrons were in the Cabaret Room. There was approximately 6000 feet of PVC insulated wiring in the plenum of the Cabaret Room alone. The fire was initially fueled by the PVC wiring.

Events around the fire were explained by the Kentucky State Police and witnesses.

# Exhibit 4

## A PVC FIRES LIST

Compiled by Greenpeace June 1994

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This is a list of accidental fires that have involved the synthetic material polyvinyl chloride.

In all of the fires, PVC was only one of many materials that burned. But in most cases it is clear that if polyvinyl chloride had not been present, the fires either would not have started, would not have emitted life-threatening gases and chemicals, or would not have spread at such a rapid rate.

The list of fires is divided into four sections which describe the different hazards of burning PVC:

- a) Dioxins
- b) Hydrochloric Acid
- c) Fire Spread
- d) Electrical Wiring and Cable Insulation

Any given PVC fire might have elements of all four hazards, but for this list a fire was included in a particular hazard section because that hazard was dominant in increasing the tragedy level of the fire.

The sections are also in the order of data availability. For example, there are few accidental PVC fires for which dioxin data is available. Even though all PVC fires will create dioxin, these are the only ones I know of that have been tested and confirmed. I came across not one incident where dioxin tests for burned PVC came up negative.

On the other hand, it is easy to find incidences of electrical wiring/cable fires. However, detailed information is limited. But if it can be concluded that PVC was involved in a wiring/cable fire, one can only infer that the fire spread rapidly, released hydrogen chloride in the smoke, and left dioxin in the ash.

### SMOKE INHALATION

The majority of fire deaths are due to "smoke inhalation". Traditionally this has meant carbon monoxide poisoning, but in modern fires, where sythetic materials release a variety of poisonous gases, the general diagnosis of "smoke inhalation" is vague and insufficient. (Journal of the American Medical Association citation)

Therefore, even though it's proven that PVC emits HCl, the PVC industry can argue there is no proof that PVC is responsible for "smoke inhalation" deaths.

It has been possible to measure the lung tissue of a victim to find if they had a lethal dose of either carbon monoxide



# Exhibit 4

wrong in the main switchgear room and a search revealed the two electricians. A fire had started in the PVC wire insulation.

Within minutes, smoke had permeated throughout the building and in many cases firefighters had to remove breathing apparatus in order to aid civilians and provide first aid to the two injured electricians. Due to the removal of the breathing apparatus, 20 firefighters received smoke inhalation.

One of the electrician died from burns over 90 percent of his body. The other died several days later from pulmonary burns or smoke inhalation.

Thorough examination of the fire room revealed that the only material which burned was the PVC covering on the wiring. There was actually very little fire in the room and all the smoke was caused by a relatively small amount of insulation burning.

According to the NFPA, this fire presents an excellent example of the problems related to smoke given off when PVC burns. Although very little wiring was involved in this fire, smoke permeated almost entirely throughout the building and resulted in numerous injuries.

source: Fire Journal

Las Vegas, Nevada  
MGM Grand Hotel

November 21, 1980

The MGM Grand Hotel occupied a city block and rose twenty six floors. The design and operation of the hotel violated codes and practices for smoke control.

Among other synthetics, the hotel had a plenum (space between the casino ceiling and the floor of the first story) that contained PVC drainage pipes (tons of plastic), and a vast electrical network, with all wires insulated in PVC plastic. Wallcovering, rigid moulded furniture, and fake leather upholstery also contained PVC.

PVC, which decomposes readily, existed in the same environment in the casino as ABS, which burns readily and emits hydrogen cyanide, and as PMMA, which burns readily and emits methylmethacrylate, which is its monomer and an irritant and nerve poison. In general, combined dosing has proven worse than single-type dosing, toxicologically.

The fire started at 7:30 am in the casino deli electrical system. The fire spread to the plenum igniting the sythetic materials. A fireball raced through the 200 yard long casino. The plastics hidden in the wall and ceiling determined the fireball speed and direction in only a few minutes.

What was unusual about this fire was the smoke: its quality, quantity, density and the number of people it killed.

# Exhibit 4

See my Letter -

\* The most striking fact about about the MGM fire was that the great majority of those killed (61 out of 85) died on the 19th through the 26th floors of the hotel. These victims were as far away from the fire as they could be and still be in the building. The smoke had risen to the top floor, accumulated, and sunk downward, then up out of the building top. Control over the fan system was lost when its PVC tubing melted in the early stages of the fire, so the fans continued to push smoke around the building.

Most of the people who died on the bottom floors died of smoke inhalation before they burned. Forty seven percent of all victims showed a sublethal level of carbon monoxide in the lungs. The avenues of the fire spread to the top floor included the air handling system, the elevator shafts, the seismic joints, the fire stairs, the electrical and plumbing systems, and even the broken windows on the windward side of the building.

Over 500 were injured. Some of them had neurotoxic reactions to their exposures. Many of the injuries, which were also incurred by firefighters were respiratory problems, sleep difficulty, irritability, depression, skin sensitivity and dryness, and problems with microcirculation in the extremities.

Attributed to chlorinated hydrocarbons were: uterine dysfunctions, excessive sweating, muscle spasms and shaking, skin rashes, acne and discolorations. Some of the strongest symptom patterns were psychological. Depression, irritability, nightmares, inability to concentrate, and relational problems with friends and family were common in survivors. Irritants and hydrocarbons both have been found to influence psychological function, especially through the catecholamine system.

In some of the victims, the red blood cells had completely disintegrated. The destruction of red blood cells has been seen in victims of other plastics fires and in lab animals exposed to PVC fumes. Hydrogen chloride destroys oxygen-carrying hemoglobin, the protein that forms the major content of red blood cells.

Some of the elements in the soot found in the lungs of the victims appears to be from PVC products: antimony, zinc, and lead, iron, chlorine, nickel, calcium.

It was concluded that the synthetic polymeric products in the casino were the source of the soot found in the rooms and in the victims broncii, because wood does not contain these elements in large quantities. It was also concluded that at least some of the soot came from the PVC products, specifically.

\* Sixty-one people died twenty stories above the fire from soot and fumes given off by burning plastics in the ground floor casino.

Source: In the Mouth of the Dragon by Deborah Wallace